Coyote Watershed Program

Santa Clara Valley Water District

LOWER SILVER/THOMPSON CREEKS HYDROLOGY STUDY

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LOWER SILVER/THOMPSON CREEKS HYDROLOGY STUDY

1. INTRODUCTION

Lower Silver Creek and Thompson Creek are located in the eastern portion of the Santa Clara Valley. Thompson Creek originates in the Diablo Range foothills at an elevation of about 2300 feet and flows northerly through the Evergreen area to its confluence with Lower Silver Creek near the Eastridge Shopping Center. Lower Silver Creek originates near Silver Creek Road at elevation of about 180 feet and flows northerly through the Lake Cunningham area to its confluence with Coyote Creek.

In this study the watershed area is the area above Lake Cunningham, which includes many tributary creeks. From North to South these tributaries are Flint, Ruby, Quimby, Fowler, Evergreen, Yerba Buena and Cribari Creeks. The upper region of the watershed is located in the steep foothills while the lower region is flatter.

The purpose of this study is to develop a hydrologic (HEC-1) model that can replicate the runoff characteristics of the 26 square-mile Silver/Thompson Creeks Watershed upstream of Lake Cunningham in the City of San Jose.

2. HEC-1 MODEL DEVELOPMENT PROCEDURES

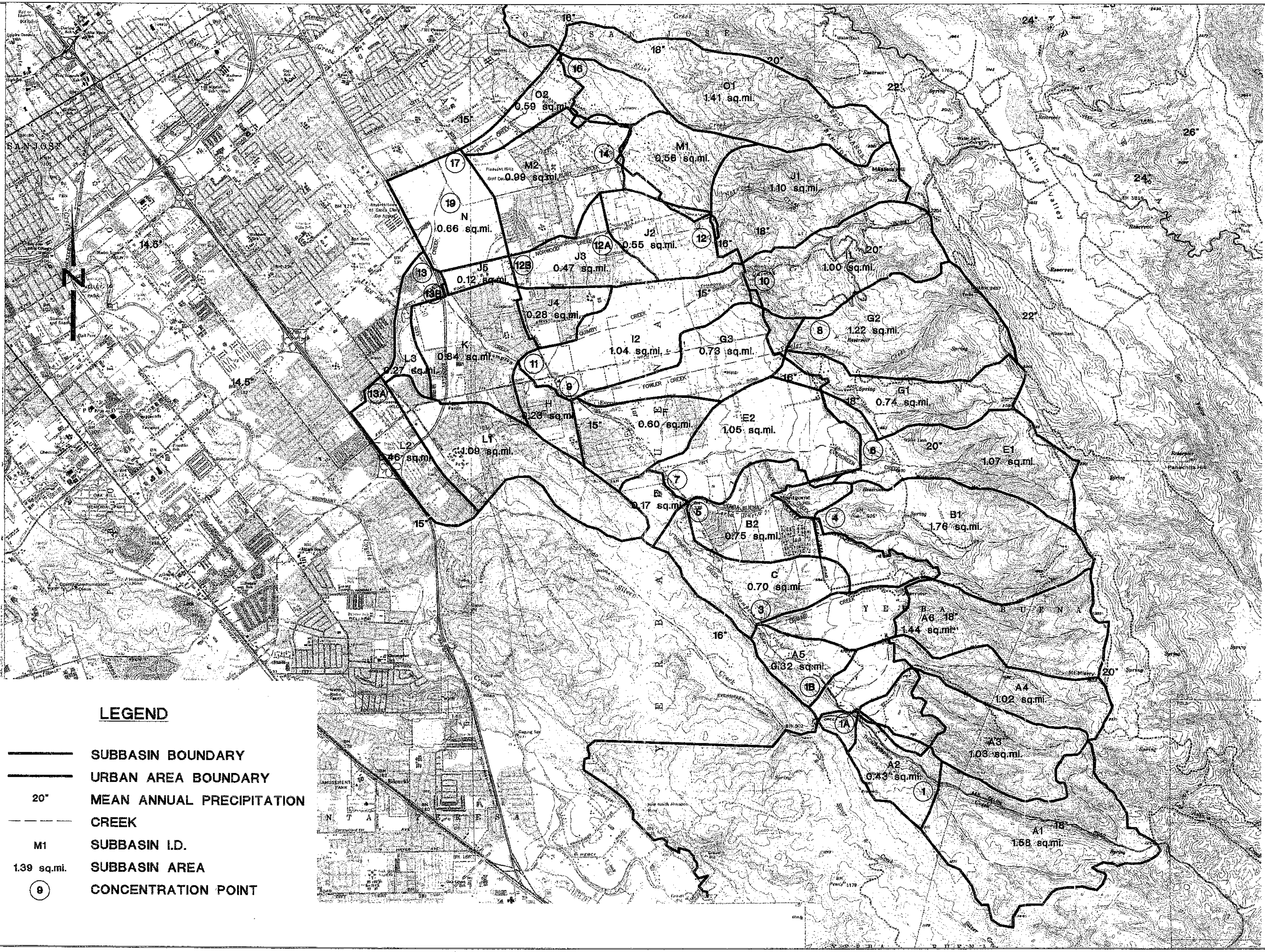
The methods and procedures used in the HEC-1 model development are based on the Santa Clara Valley Water District's (SCVWD) 1998 Hydrology Procedure. When preparing 1998 Hydrology Procedure the SCVWD Staff went through calibrations and comparisons of the various HEC-1 model parameters. In this study some parameters were developed based on discussions and close coordination with the SCVWD' hydrologists.

The methods and procedures used in this study are summarized in the following discussion.

Subbasin Delineation and Rainfall Data

The USGS 1"=2000' Quad Map was used to delineate the subbasins, which are shown in Figure 1.

There is no rainfall gage data inside of the study watershed. But there are three adjacent rainfall gages. These gages are Haskins Ranch, United Technologies Corporation (U.T.C.) and City of San Jose. The 100 year, 24 hour rainfall for these gages are listed below, shown in Figure 2.



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▬	SUBBASIN BOUNDARY
▬	URBAN AREA BOUNDARY
20"	MEAN ANNUAL PRECIPITATION
— — —	CREEK
M1	SUBBASIN I.D.
1.39 sq.mi.	SUBBASIN AREA
⑨	CONCENTRATION POINT

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SILVER/THOMPSON CREEKS
HYDROLOGY STUDY
FIGURE 1-DRAINAGE AREAS

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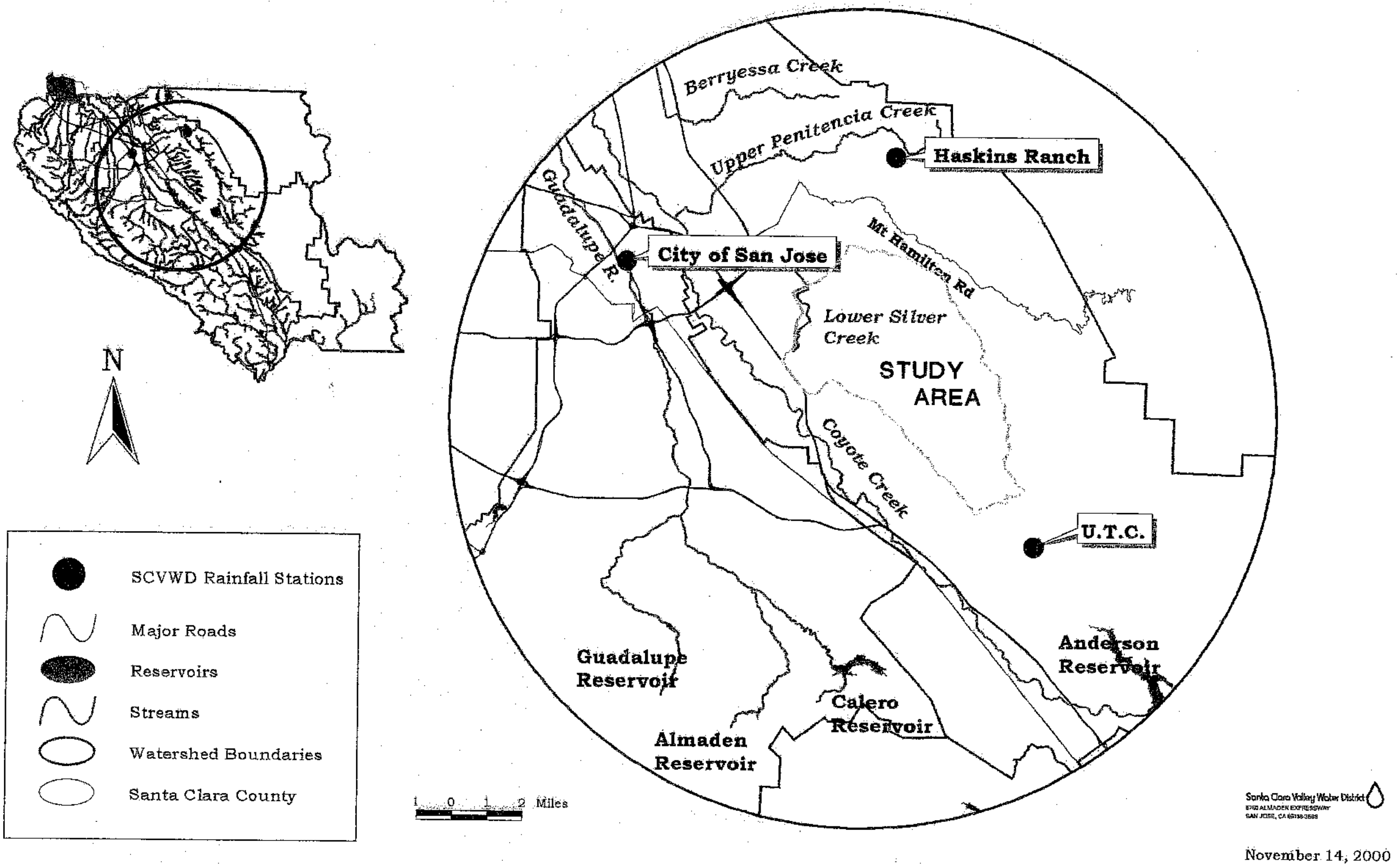

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HYDROLOGY STUDY
FIGURE 2 - RAINFALL GAGE LOCATIONS

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Haskins Ranch:	4.00 in/24hr		
U.T.C.:	4.01 in/24hr		

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911 /628
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Based on the above gage data, the average of 4.2 inches for the100-year 24 hour storm rainfall is selected for use in the HEC-1 model. The storm distribution used is the 100-year, 24 hr, 15 minutes time interval, standard project storm precipitation distribution for the Northern California Coastal Area.

236/89

Subbasin Parameters

The HEC-1 model is set up to predict the future 100-year peak flow. The General Plan 2020 of the City of San Jose is used to determine the land use for each subbasin. The land use for each subbasin is shown in Figure 3. In accordance with SCVWD's December 1998 Hydrology Procedures the urban area watersheds are partitioned into pervious area and an impervious area. The criteria used for imperviousness and the street area ratio for each land use category is listed in Table 1. The rural, pervious and impervious areas for each subbasin are listed in Appendix I.

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Table 1: Ratio Of Imperviousness And Street Area Percentage Of Urban Area

Land Use	% Impervious	% Street Area to Total Area
Rural/Estate Residential	15%	5%
Low Density Residential	30%	20%
Medium Density Residential	60%	20%
High Density Residential	85%	20%
Commercial	95%	20%
Industrial	90%	20%
Public/Quasi-Public	90%	20%
Park	20%	10%

Pc

In both pervious and impervious areas, a portion of the precipitation is lost to infiltration/interception/surface detention. The portion of the precipitation that is excess becomes surface runoff. The Loss function used in the HEC-1 model is the Soil Conservation Service loss rate function (SCS method) developed by the Natural Resources Conservation Service. The hydrologic soil groups underlying the study area are

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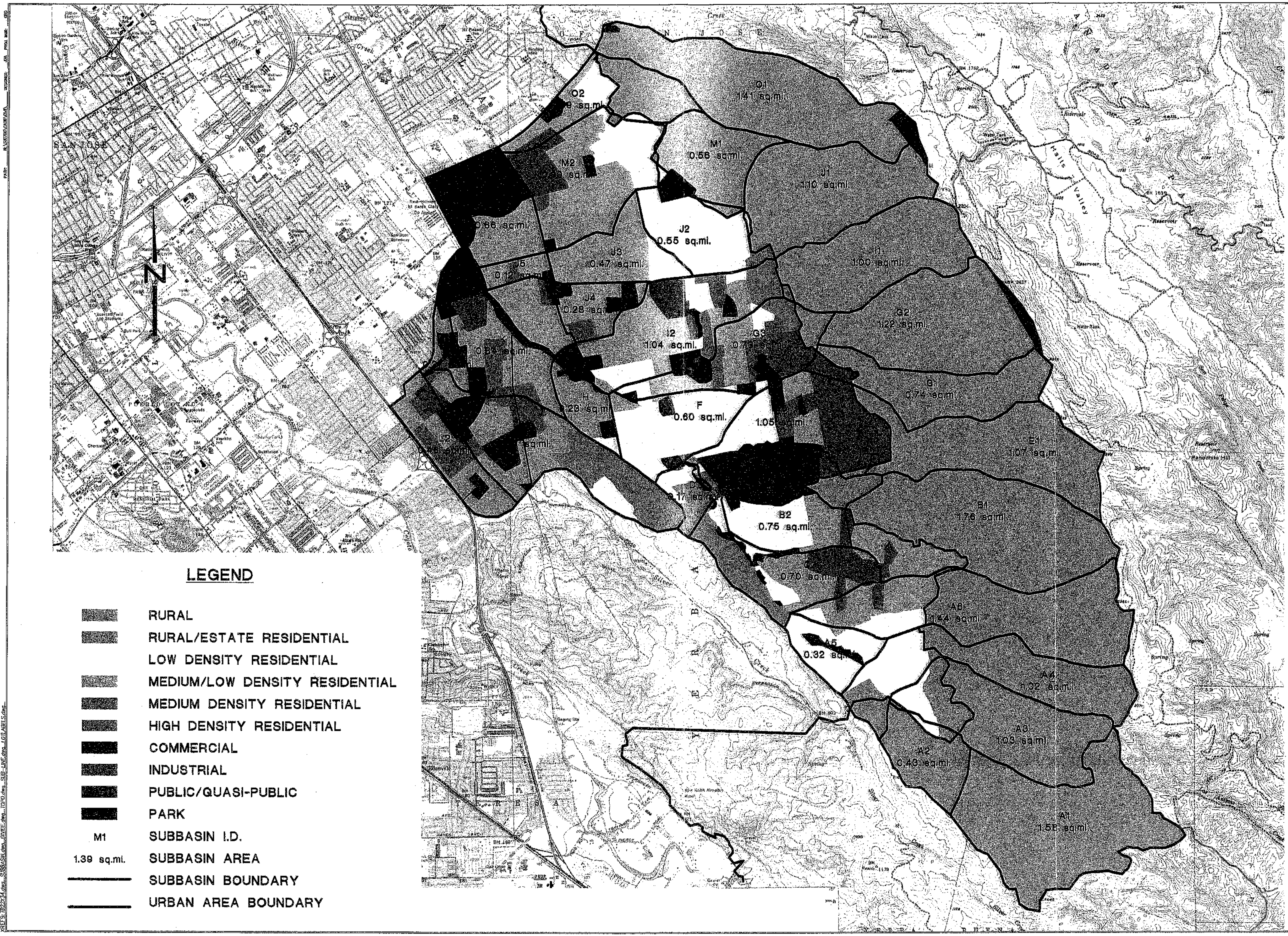

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▨ RURAL
▨ RURAL/ESTATE RESIDENTIAL
LOW DENSITY RESIDENTIAL
▨ MEDIUM/LOW DENSITY RESIDENTIAL
▨ MEDIUM DENSITY RESIDENTIAL
▨ HIGH DENSITY RESIDENTIAL
■ COMMERCIAL
▨ INDUSTRIAL
■ PUBLIC/QUASI-PUBLIC
■ PARK
M1 SUBBASIN I.D.
1.39 sq.mi. SUBBASIN AREA
— SUBBASIN BOUNDARY
— URBAN AREA BOUNDARY

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SILVER/THOMPSON CREEKS
HYDROLOGY STUDY
FIGURE 3-LAND USE

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shown in Figure 4, which was published by the U.S. Department of Agriculture in 1968. The SCS Curve Numbers which are used in the HEC-1 model are listed in Table 2 for different hydrologic soil type, vegetation cover condition of fair and antecedent moisture condition of 2.75.

Table 2: SCS Curve Numbers

SCS Curve Numbers							
Rural Area				Urban Area			
Cover Type	B	C	D	Cover Type	B	C	D
Wood-grass	75	88	92	Open	82	90	93
Woods	79	85	90	Paved	99	99	99

The excess precipitation (total precipitation minus losses) is routed as surface runoff to the basin outlet or to the storm drain system and then to the basin outlet using the Clark's Synthetic Unit Hydrograph method. For the Clark's synthetic unit hydrograph there are two parameters to be determined. These two parameters are time of concentration T_c and storage coefficient R. The Kerby-Hathaway equation is used for calculation of the time of concentration for each watershed subbasins.

Kerby-Hathaway Formula:

$$T_c = 0.01377\left[(Ln)^{0.47} S^{-0.235}\right]$$

Where T_c is the time of concentration in hours, L is the distance of overland flow travel in feet, n is the Manning's watershed roughness coefficient for overland flow and S is the average overland slope in ft/ft.

The total time of concentration for the impervious area is the sum of travel time of impervious area and the curb. The total time of concentration for pervious area is the sum of the total impervious area travel time and pervious area travel time.

The Clark's storage routing coefficient R is chosen such that for pervious areas: $R/(T_c + R) = 0.75$, and for impervious areas: $R/(T_c + R) = 0.4$.

The detail calculations for the subbasin parameters such as SCS Curve number, time of concentration, and storage coefficient are listed in Appendix I.

Storm Drain and Channel Routing

Surface runoff from the impervious area and the pervious areas with storm drain systems are combined and then routed to the outlet of the urban area using a special storage-discharge relationship. These equations were specifically developed by SCVWD and apply to urban areas of the type found in Santa Clara County. The general unitized storage-discharge rating curves for different urban conditions and the storage-discharge rating curves for each urban subbasin are listed in Appendix I.

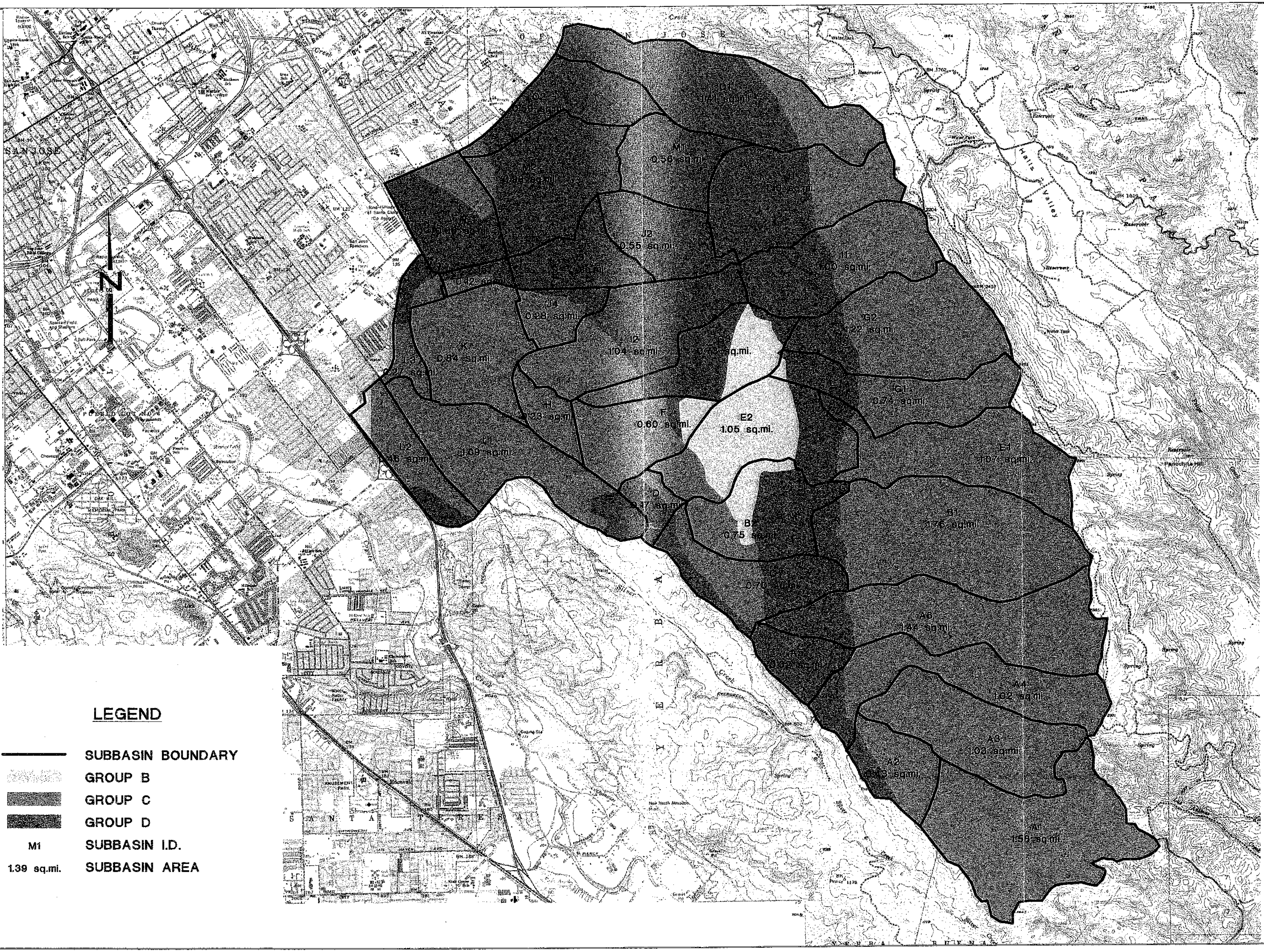
The flow was routed through the Creeks from upstream to downstream using Muskingum-Cunge Routing Method. The routing schematic of the model is shown in Figure 5. The SCVWD Flood Control Facilities Map and the existing HEC-2 models are used as a reference for cross-sectional geometry and hydraulic roughness values for channel routing data in the routing analysis. These routing parameters are listed in Appendix I.

3. HEC-1 MODEL RESULTS

The HEC-1 input parameters are summarized in Appendix I in this report. The input and output are listed in the Appendix II and Appendix III respectively. In Appendix IV meeting minutes are presented which document discussions with SCVWD concerning the HEC-1 model input data. The results of the new model for the concentration points along the Creeks are listed in Table 3.

Table 3: HEC-1 Model Results

Peak Flow (cfs)		
Concentration Point	Reference Location	New HEC-1
1	Thompson Creek Downstream San Felipe Creek	305
3	Thompson Creek at Cribari Creek	1215
5	Thompson Creek at Yerba Buena Creek	1838
7	Thompson Creek at Evergreen Creek	2271
9	Thompson Creek at Fowler Creek	2928
11	Thompson Creek at Quimby Creek	3330
13	Lower Silver Creek at Norwood Creek	4298
19	Lower Silver Creek at Lake Cunningham	5059



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—	SUBBASIN BOUNDARY
░	GROUP B
▒	GROUP C
▓	GROUP D
M1	SUBBASIN I.D.
1.39 sq.mi.	SUBBASIN AREA

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SILVER/THOMPSON CREEKS
HYDROLOGY STUDY
FIGURE 4-SOIL GROUPS

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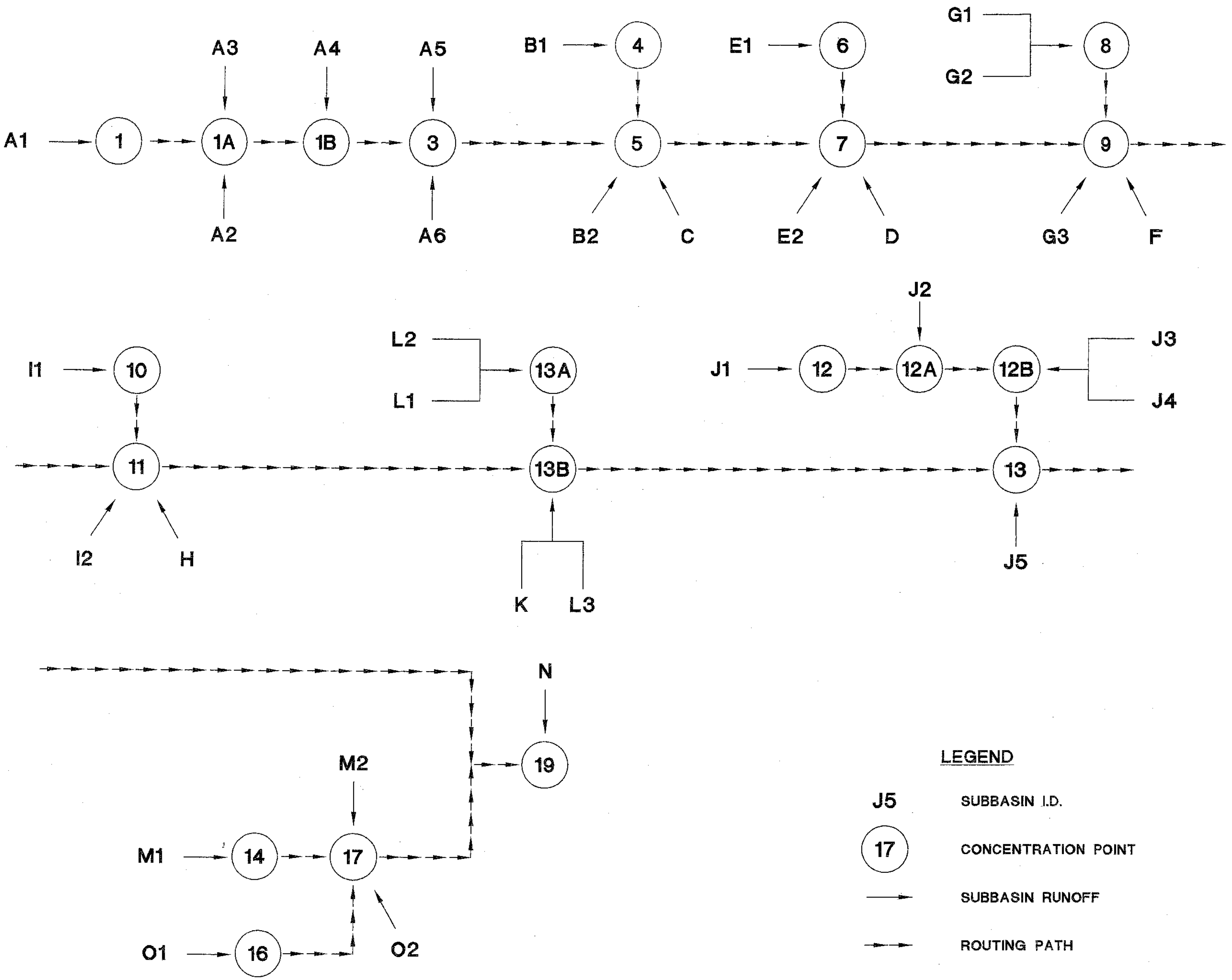

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SILVER/THOMPSON CREEKS
HYDROLOGY STUDY
FIGURE 5-ROUTING SCHEMATICS

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Reference:

1. A.D. Saah, *Santa Clara Valley Water District Hydrology, Documentation for the East Flood Control Zone*, Santa Clara Valley Water District, July, 1978
2. U.S. Army Corps of Engineers, Hydrologic Engineering Center, *HEC-1 Flood Hydrology Package*, User's Manual, Davis, CA, September, 1990
3. United Sates Department of Agriculture , Soil Conservation Service, *Soils of Santa Clara County*, Berkeley, CA, August, 1968
4. United States Department of Agriculture, Soil Conservation Service, *Urban Hydrology for Small Watersheds, Tech. Release No. 55*, Washington, D.C., 1986
5. J.C. Wang, W. Cheng, T.L. Marks, G.Q. Tabios III, *Hydrology Procedures*, Santa Clara Valley Water District, December, 1998